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ABSTRACT

The purpose of this inquiry was to determine the perceptions of certain secondary students in the Greater Cincinnati (Ohio) area who experienced an integrated curriculum that combined the subjects of geometry and visual art. A mathematics teacher and a visual arts teacher collaborated to facilitate student discovery by implementing creative problem-solving strategies that make unique connections between the traditional subjects of geometry and art. Specifically, students explored paper engineering concepts while designing three-dimensional pop-up greeting cards. Understanding of how secondary students perceive integrated curriculum in the context of human experience was generated through surveys and semi-structured interviews with the students who participated in the integrated project. Since many students often see little relevance in school life, the study also addresses how integration connects subject areas in ways that reflect real world applications of mathematics and art in industry. Implications of the study are based on the cross-curricular connections students discover as they bridge the gap between their classrooms and the real world of problem solving. Appendices include survey and feedback forms. (Author/PVD)

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Related Webs of Meaning Between the Disciplines: Perceptions of Secondary Students Who Experienced an Integrated Curriculum

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Related Webs of Meaning Between the Disciplines: Perceptions of Secondary Students Who Experienced An Integrated Curriculum

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Abstract

The purpose of this inquiry is to determine the perceptions of certain secondary students who experienced an integrated curriculum that combined the subjects of geometry and visual art. The research took place in a suburban high school in the Greater Cincinnati area. A mathematics teacher and a visual arts teacher collaborated to facilitate student discovery by implementing creative problem solving strategies that make unique connections between the traditional subjects of geometry and art. Understanding how secondary students perceive integrated curriculum in the context of human experience was generated through surveys and semi-structured interviews with the students who participated in the integrated project. Since many students often see little relevance in school life, the study also addresses how integration connects subject areas in ways that reflect real world applications of mathematics and art in industry. Implications of the study are based on the crosscurricular connections students discover as they bridge the gap between their classrooms and the real world of problem solving.

Running head: RELATED WEBS OF MEANING

Introduction

Unsatisfied with the traditional subject centered curriculum and the lecture style approach to teaching, over the past three years Nancy, a high school mathematics teacher and I teamed to facilitate student discovery by implementing creative problem solving strategies that make unique connections between the traditional subjects of mathematics and visual art. Among other commonalties, our team approach proved successful since we are both desirous of continuing to make our classrooms not only exciting but relevant and meaningful. Guided by the belief that everything interconnects, I recently assumed the role of researcher in integrated curriculum hence, wading deeper into the interconnections so that I might begin to articulate the shifts in assumptions that underlie student perceptions. For instance, often after introducing a group of secondary students to an integrated mathematics and art lesson lesson Nancy and I invariably met rolled eyes, groans and epithets such as *"big projects are a nightmare"* and *"math doesn't have anything to do with art."* The consensus seemed apparent: integrated projects were viewed initially as an unwelcome challenge. However, as I observed and listened to students as they worked through the process of problem solving within an integrated format, I realized that the "mathematical and artistic nightmares" waned and were replaced by much more positive understandings. Once they actually began the integrated project, they went on to solve the problems with some degree of ease and by the end most could begin to reflect on how rewarding the experience had been.

Also noticeable were the students' reactions at the conclusion of the integrated projects. Although many seemed to have forgotten their initial anxieties, their fears and comments were exact duplicates of others who had experienced our integrated projects previously. I began to wonder whether there were universal aspects that most students might expect to experience when undertaking such an endeavor. By listening to the students, could I identify commonalties that would lead to a better understanding of the students' perceptions and expectations of integrated curricula? and, as a result, could I develop a more effective means of designing and implementing integrated lessons as well as alternative assessment strategies? These questions intrigued me and led me to further explore ways to determine the feelings secondary students have regarding the integrated approach to critical thinking and problem solving.

Rationale for Curriculum Integration

Clearly, with knowledge constantly growing and changing in all areas of study, it is important for educators to prepare young people to be adaptable thinkers, researchers, and problem solvers. To achieve this we must recognize that the subject areas or disciplines of knowledge around which the curriculum has traditionally been organized are, in reality, arbitrarily defined territories carved out by academics for the convenience of 'advanced' study (Beane, 1991). These disciplines contain much of what is known, but their boundaries serve to fractionalize knowledge into artificial components thus, limiting our ingenuity. In real life problems are not soived in 50 minute time blocks of art, science, social studies, mathematics, and language arts. Rather, data are gathered from all of our resources to generate solutions that are essentially multi-disciplinary in nature (Jacobs, 1989). The traditional subject-centered curriculum does not reflect the social reality that our students experience in their everyday lives.

According to Jacobs (1991), the discipline oriented structure of traditional curricula has contributed to the current crisis in American schools. Many young

people are physically dropping out, while others drop out mentally, sitting passively in their classrooms waiting to survive the day. An integrated curriculum would provide opportunities for students to explore connections between the disciplines and their everyday existence. Also, an integrated curriculum would help learners to perceive connections between the disciplines. The sense of 'connectedness' nurtured by an integrated curriculum should enable students to perceive the relevance of education to their everyday lives. This heightened awareness of educational purpose should motivate students to become life-long learners--an essential characteristic of a modern citizen, enabling them to adapt to the demands of an unknown future (Adler, 1982).

The student characteristics developed through an integrated curriculum, namely a sense of connectedness and habit of life long learning, comprise essential components of an active citizen in a democratic society (Dewey, 1944). If society is to grow and flourish into the 21st century, it is vital that our young people have an ability to adapt to a transformed future coupled with a sense of community. Reich (1991) has observed that, at present, only a few of our young people are equipped with the skills required for future prosperity. Further he proposes (1991) that this educational failure will create a nation divided, in which citizens no longer have a vision of the common good. An integrated curriculum would appear to address these concerns with adaptability and by fostering the sense of community that is developed through shared goals, cooperation, and teamwork.

In June of 1991, the U.S. Secretary of Labor formed a commission called *SCANS*, which is an acronym for Secretary's Commission on Achieving Necessary Skills, to investigate the requirements of today's and tomorrow's work place and to determine the readiness of our high school students to meet those requirements (Erickson, 1995). This national commission published a report, *What Work Requires of Schools*, in which they identified five competencies all students should have upon high school graduation, namely, resource management, information acquisition and usage, interpersonal skills, understanding of complex interrelationships, and the ability to work with a variety of technologies. "More people lose jobs because of poorly developed competence in these areas than because of lack of content knowledge" (Erickson, 1995, 27). Each of the five competencies reflect cooperative problem solving strategies necessary in the real world work place of today's information age.

Methodology

The purpose of this inquiry was to determine the perceptions of certain secondary students involved in an integrated curriculum project that involved the subjects of mathematics and visual art. A secondary purpose of this inquiry was to determine the efficacy of an integrated curriculum on the problem solving and critical thinking skills of secondary students. The project itself was designed to enhance higher levels of thinking through creative problem solving activities that involve the integration of mathematics and art. The project took into consideration students of all abilities and was designed to reinforce theorems about parallel, perpendicular, and intersecting lines and planes in conjunction with the basic elements of art and principles of design.

Specifically, we planned to facilitate student understanding of how to create three dimensional pop-up greeting cards. Students explored paper engineering concepts through a hands-on approach to discovery learning and realistically simulated the die-cutting and design methods used in industry. They identified a

hypothesis of the mathematics involved in creating their own pop-up card design, then tested it by making a prototype of their card design using x-acto® knives and drafting tools. Mathematically, the students studied tessellations, symmetrical patterns, transformational geometric designs, and Mandelbrot fractals. Artistically and historically, the students studied the work of M.C. Escher, the art elements of line, shape, space, color, and value, and several principles of design including balance, proportion, and rhythm.

The real world applications of mathematics and art were supported by an internationally known American greeting card manufacturer that lent valuable support by becoming involved in the education of our students. The project culminated in a field trip to the company where in addition to learning about potential career opportunities, the students also toured the departments of production printing, die-cutting, and creative graphic design.

By understanding student perceptions, I hoped to discover if students, who had experienced an integrated curriculum approach, would began to bridge the gap between their academic classroom experiences in mathematics and art by connecting the application of these skills to the work place.

Site Selection

This study is based on the perceptions of a collection of secondary school students ranging from freshmen to seniors, all of whom were taking either a geometry or level one visual art class in high school. The students, who have either limited or no experience with the integrated curricular approach, normally meet every day for 50 minutes of instruction in either geometry or visual art. During the month long pop-up greeting card project, the geometry and art classes were combined six times in one classroom for a 50 minute block of team teaching.

As the only visual art teacher in the school, the researcher was a privileged insider working in conjunction with the geometry teacher. Both female teachers have previously designed and implemented integrated curricula and have a special interest in the collaboration of mathematics and visual art. Demographically, the school district which is mainly composed of white, working class families, is located in a small suburban community within the greater Cincinnati area.

Informant Selection

All participants involved with this study were enrolled in either a geometry class or a level one visual arts class at the high school level. This naturally bounded group of students is accustomed to a traditional subject centered curricula and have either no experience or very limited experience with an integrated approach. All participants were asked to "talk back" on two written surveys (Appendix A & B) about the integrated project, first at the project's inception and second upon its completion. The anonymous responses were analyzed and summarized by the researcher to help generate questions for the semi-structured interview process.

A release form (Appendix C) was distributed to all potential informants to inform parents and guardians of the basic study and the interview process. After reading the letter which clearly indicated; there were no right or wrong answers, guaranteed confidentiality, there was no risk to the informant, and the informant had the right to terminate the conversation at any time, the parents and guardians were instructed to return a signed permission slip to the researcher. Beyond the criterion of being an art student who exhibited a positive attitude during the pop-up greeting card project and about school in general, there were no specifications to be met. Informants ranged from freshmen to seniors; five females and four males

were interviewed. Two of the informants had participated in an integrated curriculum project with us the previous school year; the remaining seven informants had never experienced integrated lessons involving more than one subject at the high school level.

Although both geometry and art students participated in the written pre-project and post-project surveys, only the visual art students were chosen to participate in the semi-structured interview process. After initially interviewing a female freshman, who demonstrated a particular interest in the project, subsequent informants were selected for interviews based on the exhibition of a positive attitude toward the integrated project in particular and toward school in general. Initial semi-structured interviews were designed to determine students' basic approach to problem solving within an integrated format versus the traditional approach they were accustomed to and their general feelings about the project and the finished product (their pop-up greeting cards and portfolios). Subsequent interviews expanded on the topics of incentives and motivational factors as well as anxieties and frustrations students encountered as they participated in the project.

Data Gathering

Interviews took place after school in the art room at the high school. The semi-structured interviews occurred over the course of four weeks. Each informant was interviewed in a single session lasting between 35-45 minutes. Scripted questions (Appendix D) and handwritten notes were used throughout these interviews and transcribed into a computer within hours of each interview. The researcher probed with an initial grand tour questions that allowed the interview to take its own course. For example, "Tell me what kind of a job ---High School has done preparing you for college or the work place," and "Tell me about the time period (sequence of events) in which you started and finished the ---Greeting Card project?"

Informants commented on past curricular experiences, their feelings about the ----Greeting Card Company's involvement, the pop-up greeting card project, traditional curricular designs versus integrated curricular designs, future college or work plans after high school, and their perceptions about the relationship between mathematics and art.

Analysis

A collection of field notes, surveys, and notes from semi-structured interviews, and passages from written documents, comprised the text. The analysis of textual data employed the *constant comparative method* which is based on a continuous process of data gathering, analysis and reanalysis (LeCompte & Preissle, 1993). Throughout the study, the researcher constantly analyzed textual data and the subsequent data gathered was influenced and structured by the analyses that preceded it. Upon completion of the integrated pop-up greeting card project, interviews were conducted and recorded by hand scripted notes which were entered into a computer within hours after each session.

Initial deconstruction of the text followed and meaningful parts were organized into *thinking units* (Hofmann, 1996). Thinking units were used with initial textual analysis to suggest theoretical connections between conceptual segments of text and the researcher's initial conceptual framework. For example, the integrated curriculum approach shifts to an emphasis on metacognition and learning how to learn with individual subject contents lessening in importance. Another thinking unit involved recognizing how and when we teach a student high order

competencies. By integrating the subject areas students learn that high-order thinking skills are generic and can be used outside the classroom. The integrated curriculum approach shifts from an emphasis on applying themes to subject areas and to focusing on the commonalties across disciplines. Given today's educational technologies and the emphasis on metacognition, critical thinking skills are the organizing principle for order and structure. In my approach the content and procedures of individual disciplines are transcended allowing decision-making and problem-solving to involve the same principles regardless of discipline.

Moreover, thinking units were informed by the researcher's relevant reading and actual experiences relevant to the integrated curricula approach. For example, the traditional approach to curriculum assumes that all intended student learning occurs at the level of discipline based content. Therefore, the adoption of an integrated curriculum should provide opportunities to include two levels of student learning, the content (curriculum) and the skills (metacurriculum) (Jacobs, 1989). The content based learning would provide access to important ideas and knowledge of the known world of the disciplines and the skills, integrated with the content, would enable students to develop the capacity to think and learn independently, the so called "habits of the mind" (Sizer, 1992). Given today's educational technologies and the emphasis on metacognition, critical thinking skills must be the organizing principle for order and structure. Potential topics and categories that existed within the textual units were related to how an integrated curricular approach shifts to an emphasis on metacognition and learning how to learn with individual subject contents lessening in importance. The questions became: "Through this approach are we teaching the student high order competencies?" and "Are the students learning that high-order thinking skills are generic and can be used outside the classroom?"

Conceptually meaningful text segments were identified within a textual unit. These *conceptual textual segments* (CTS) were identified and highlighted within the text (Hofmann, 1996). As broad categories with evaluative dimensions began to emerge throughout the course of data gathering, the construction of categories was formed. During the course of the semi-structured interviews, surveys, and field notes, process patterns in responses were evident and resulted in five categories. These categories included **anxiety, motivation, significance to the real world, relationships between mathematics and art, and transformations.** The following is a brief summary of the categories and their dimensions:

Anxiety was established as the first category. Students felt overwhelmed at the beginning of the project and anxious about having neither enough time to meet the deadlines nor the essential skills (mathematical and/or artistic) to successfully complete the greeting card project. **Motivation** in the form of rewards emerged as the second category and was reflected in the informants' ambition levels. Informants expressed the presence and absence of rewards as being directly related to their desire to try harder on not only the greeting card project but on any project. **Significance to the real world**, the third category, relates to the connections students make between integrating different subjects and the ability to see the big picture as it relates to the real world of work and college. Students felt that our ongoing communication with an area greeting card manufacturer, not only helped make clear the incorporation of geometric theorems and artistic elements and principles but also validated their finished works. The fourth category, **relationships between mathematics and art**, emerged from the informants ability to connect mathematics

and art in a way that explored the possible links between the two subjects. The final category, which includes the dimensions of coping with the paradigm shift from a traditional subject centered curriculum to an integrated approach, is best described as **transformations**. Most of the informants were not sure if, as high school students accustomed and trained within a traditional subject centered curriculum, they were ready to have all of their classes integrated.

Trustworthiness

Trustworthiness was measured through member checks and peer debriefing with Nancy and my university colleagues. Saturation occurred particularly in the area of the potential cross curricular connections. For example, retrospective of the pop-up greeting card project, all members were able to articulate the relevance of an integrated curricular approach and the potential real world applications. Furthermore, after reading summaries of categories generated from their interviews, informants gave "member check" support to the analyses and admitted to not expecting any real concern for their opinions and perceptions about integrated curriculum. Surprise gave way to genuine interest as they realized that their voice was important enough to be considered by their art and mathematics teachers. After reading the summaries, several informants felt significantly empowered by the narrative as evidenced by their unsolicited insightful suggestions for improving future studies on integrated curricula.

Interpretations

Research findings in the form of categories, cluster around two themes that describe informants' perceptions of integrated curriculum. Examination of patterns among the four categories provided two general themes: **Connections and Change.**

Theme One: Connections

Comprised of two categories: significance to the real world and relationships between mathematics and art, the connections theme encompasses participants' abilities, after experiencing an integrated approach, to contextually relate school subjects to the world outside of the classroom and to understand that content boundaries often are dissolved and permeated. For the purpose of this analysis each category which comprises this theme will be summarized and then the thematic pattern among each category will be discussed.

Significance to the Real World

Significance to the real world, emerged as a component of the informant's realization and understanding of what they will need to know upon graduation in order to function in a world of constant flux. Significance to the real world, as constructed by the informants, involves the practicality of a lesson and clearly, the importance of how school relates to the outside world is very important to them. *"Geometry has become real to me, not just a subject in school."* Real world applications of mathematics and art were reinforced by duplicating the methods used by industry. Students supported the idea of making learning exciting and as well as relevant and meaningful. *"During this project, I learned a lot about geometry in a fun way instead of the conventional way of the book. It has also given me an interest in working at the ---Company."*

Potential career opportunities in mathematics and art were described as bridging the gap between their academic classroom experiences and the application of these skills in the work place. *"I feel that my project [pop-up greeting card and portfolio] turned out rather professional...I am proud to have the ---Greeting Card Company view my project."* Students were excited upon completion of the project to learn that

they were capable of producing a quality work comparable to what a professional card maker could create.

Relationships Between Mathematics and Art

The second category in the connections theme is germane to the students ability to relate mathematics and art. Relationships between mathematics and art's dimensions included, as related to student to curriculum understanding how the two subjects exist at many curricular levels; as related to teacher to curriculum understanding of how to implement the curriculum appropriate to student learning abilities and available resources. Relationships between mathematics and art occurs during the course of finding relations to effect coordination of mathematics and visual art education.

Often there is no perceived overlap between the epistemology of one group and another group. Before the greeting card project was underway, I asked the art students to think of a math or science element in the art projects they were constructing, they began mumbling, *"I failed my geometry course," "I'm artistic I don't do math," "Art and science are different," and "There are no connections between art, science, and math."*

Many students felt that in art class they had found a refuge from math and science. The collective "hunch" was that no relationship exists between visual art, mathematics, and science. After completing the greeting card project however, informants provided much different feedback. *"I took geometry but had a hard time understanding it. Now I see how the Pythagorean Theorem relates to a three dimensional works of art."*

After being prodded several art students identified scientific or mathematical concepts in their previously completed studio experiences. For instance, one junior boy in his third year of art and first year of geometry realized, *"Now I understand how important it was to have everything congruent when reconstructing a 3-D architectural model like my Parthenon Greek temple I made of foam core last quarter during our study of Classical architecture"*

They had not connected this information before high school and the relationship between mathematics, science, and art was not brought to their attention until they participated in the greeting card integrated project.

> *In making this [greeting card] project we learned more by actually doing this hands-on project because we became familiar not only with the art elements like line and color but with the theorems and postulates of geometry. Now I can remember them because I have something to link them to.*

When the ties between art and mathematics were brought into focus, the students began to brainstorm other subjects that related to art. When asked what type of integrated unit they would plan if they were the teacher, many commented on the art, history, and language arts connection. When asked how he would design an integrated project a sophomore boy remarked,

> *I would organize social studies with other things because it would be much more interesting if we could say see a Spanish artist's work when we studied The Spanish Civil War or learn a poem in Spanish. I learn much better if I can see what someone is talking about.*

Summary of Theme

A major point of the integrated approach is to encourage the student's critical thinking about career goals and employability skills. The theme of connections emerged as integral to these informants attitudes toward integrated curriculum and to recognize the need for life long learners and creative problem solvers. Significance to the real world and relationships between mathematics and art, were both positive outcomes of the integrated greeting card project.

By reinforcing what is important to know, the teachers were able to contribute to the students' understanding of both the practical as well as the theoretical aspects of integrated curriculum. Almost all students will go on to post secondary institutions and/or work at a paying job after high school. Some will never earn a bachelor's degree but whether their plans include college or not, integrated curriculum will help connect them to the real world to fulfil their chosen career goals.

Theme Two: Change

Transformation, anxiety, and motivation are the three categories that comprise the theme of change. Change is best described as a phenomenon that requires one to step out of ones' "comfort zone" and the impact this has on the informants' school experience is relevant. For the purpose of this analysis each category which comprises this theme will be summarized and then the thematic pattern among each category will be discussed.

Transformations

Transformation requires people to challenge the rules and run the risk of failure. Because things change when new information comes into existence, it is no longer possible to solve today's problems with yesterday's solutions and all of the informants agreed that in the future it would be necessary for them to use their creative abilities to find new answers, new solutions, and new ideas. Two of the informants, both seniors and female, were particularly hesitant to embrace a totally transformed curriculum.

> *Personally, I like to study just one subject at a time and then possibly combine them after I know what I'm doing. I don't know if I'd like a totally integrated education because I'm used to the old way.*

However, all of the informants felt that if they had been exposed to an integrated curricular approach early in their school careers they would feel more comfortable with it and certainly approach problem solving differently.

> *Integrated curriculum is probably the wave of the future and I can see how kids who grow up with it would probably get a better education. It's a smart way to get kids involved with two or more things and teaches us how to put two and two together.*

Anxiety

Anxiety took two forms for the informants. Anxiety as related to time constraints and deadlines, occurred due to what they perceived as a lack of class time in which to complete the work required. *"When I first read what was involved I thought*

it [the project] sounded really cool and unusual, but was afraid that I would run into the trouble of finding time to do it."

Another source of anxiety for the informants stemmed from not making the connection between the two subjects of mathematics and art at the outset and becoming frustrated and stressed out as a result. *" I felt freaked out by the math...thinking it would be too hard and I just couldn't do it."* Many of the informants, who were all art students, related to what they perceived as a lack of necessary mathematical or artistic skills to complete the project. *"I enjoy being creative and showing off my work but I was also a bit overwhelmed with the tessellation idea, which was new to me and seemed like a lot of math."*

Nancy and I were able to alleviate some of their anxieties since we combined and team taught our classes. Therefore, one teacher was always readily available to the students throughout the project, lending either artistic support to the analytical mathematic students, who had not taken an art course in their high school career or to the artistic students, who were intimidated by the math.

Motivation

As student interest grows, teaching becomes more fun and challenging. When special interest is shown in students they know you care about them and they want to do well. Our students had the opportunity to see immediate results from their hard work and determination which elevated their interest and commitment to learning. For example, of the 200 students who participated in the project, Nancy and I selected the best 30 finished portfolios, including the actual pop-up greeting cards the students designed, to be sent to the ---Greeting Card Company for evaluation. The top fifteen students were invited to attend a field trip to the plant to witness first hand all that is involved in the design, sales, and production of greeting cards and gift wrap. One informant who attended the field trip noted,

> *It was motivation for me to get to meet some of the ---Greeting Card Company's workers and talk about what they like about their jobs and see how they make cards. I learned there is a lot more math to greeting cards than I thought.*

Five of the seven informants admitted to being more motivated by material rewards such as field trips, scholarships, and prizes. *"Rewards and incentives make me try a lot harder to make something look good."* All of the informants agreed that good marks on their report cards were important to both themselves and their parents. *"Good grades do motivate me because they make me feel smart. I always do a good job to earn them."* Personal intrinsic satisfaction for a job well done was particularly important to one senior boy who confessed, *"I always try to do my best to impress myself and my teachers."*

Summary of Results

In a world of sound bites, computer bytes, and the Internet, presentation is everything to teachers who want their students to succeed and make a difference. Teachers are seeking more effective teaching tools and one of those tools is integrated curriculum. However, only through trial and error will educators acquire the skills necessary to make relevant connections for students to enter a world that is ever in a state of flux and transformation. Essentially, integrated curriculum must evolve as a change for secondary schools. When students of education and experienced teachers alike examine the practices of integrated

curriculum, it becomes clear that the integration process is still evolving, and content boundaries are dissolving. The structures by which we have traditionally defined education are being reconstructed into new ways of thinking, believing, and behaving (Jacobs, 1989).

After educators and students have experienced and internalized the concept of integrated curriculum, their classrooms will probably never look the same to them again. People experience satisfaction for a job well done and most feel the rewards are worth the extra effort. For teachers, the rewards include highly stimulating professional experiences that energize our practices in addition to the challenge of working collaboratively with their colleagues. However, the biggest motivator for a teacher is student satisfaction. Happy students, excited about learning, make it easier to walk into that classroom day after day. As student interest grows, teaching becomes more fun and challenging. We feed off the success and renewed interest of our students and see immediate positive outcomes.

Not only does integrated curriculum provide inspiration and motivation to teachers, students also reap the rewards from being truly engaged. It gives them the opportunity to see immediate results from their hard work and determination. It also elevates their interest and commitment to learning. We used to tell students sitting in class will pay off 10 years down the line but kids today don't buy that any longer. With integrated curriculum and portfolio development, students see an immediate result for their hard work and they'll still see it pay off down the road. This approach is as much a boon to teachers as students because it gets everybody excited about learning. It has also been my experience that parents are delighted by the results.

Integrated curricula transcend the traditional scope of fragmented curricula by fusing together disciplines and fostering all five of the *SCANS* competencies. Each of the five competencies reflect cooperative problem solving strategies necessary in the real world work place of today's information age. Today, workers are required to be independent thinkers as well as team problem solvers. Combined, the *SCANS* competencies promote the development of these higher skill levels; addressed vis-a-vis an integrated curriculum the school experience promotes thinking students. According to Erickson, "Our future will accept no less" (1995, 27).

At the heart of this study are serious epistemological questions. Jacobs (1989) suggests that students should study epistemological issues such as "What is knowledge?" and "How can I best access knowledge?" and that researchers and curriculum developers should address these questions. The possibility of meeting the competencies which involve seeing patterns, interactions, and relationships, and to experience the power of collaborative group process will not be accomplished through the traditional didactic lecture (Erickson, 1995). Depth of instruction once meant the teacher lecturing to students, relaying mere facts about a single topic. "Today, depth of instruction means teaching higher level, conceptual thinking by connecting ideas across disciplines to extend understanding, foster sound generalizations, and create new knowledge" (Erickson, 1995, 35). Integrated curricula, promote the creation of new knowledge as disciplines are fused together in a way that reflects the real world in which we live. Connecting disciplines more sufficiently promotes generalizations and inquiry related to establishing generalizations. Therefore, instruction must go beyond rote memorization drills if students are to be prepared to synthesize information and make sense out of the synchronization.

This research is practical as well as theoretical and I believe it has the potential for three contributions to the field of education. First, assessing the effects of interdisciplinary curriculum on the critical thinking and problem solving skills of secondary students is extremely important to practitioners as secondary curricula becomes more integrated. Second, the study will not only inform teachers and curriculum specialists, but also the curriculum field. Third, the study may also contribute to the literature on qualitative program evaluation. Integrated curriculum is enjoying both a renaissance and a resurgence of popularity. However, the need to determine student outcomes as a result of having experienced integrated curriculum has not been sufficiently studied. Obviously, teachers are aware of the necessity of developing and implementing curriculum from a clearly established set of objectives matched by appropriate evaluation tools and clear outlines of learning outcomes and evaluations are critical. Evaluation in its traditional sense can not "measure" what is being taught in integrated classrooms since integrated objectives and evaluation is much different than it is for traditional curriculum.

As curriculum developers gain an understanding of how this can better be facilitated, the task of designing and implementing integrated curriculum should become easier. This study will perhaps help to encourage further use of curriculum integration in our schools since one way for teachers to stay motivated and informed is by encouraging feedback from students. Although we get feedback about our teaching through formal evaluations by school districts, it is after all teachers and students who interact everyday. Soliciting feedback from students is essential for teachers who want to find out what's working in the classroom. An attentive motivated classroom makes for a happier more motivated teacher. By asking students how we are doing, not only will we begin to answer some confusing questions about the integrated curricular approach but we may also be surprised by the genuine credence of their voices.

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Appendix A
SCORED SURVEY

As you have taken other courses at ---High School you have encountered a variety of teaching strategies used by educators. This "pre-project" survey attempts to draw your comparisons between an ***integrated curriculum*** *(lessons that combine more than one "subject" at a time such as geometry and art) as it will be used in the ---Greeting Card project and a* ***traditional curriculum*** *(lessons that involve only one "subject" at a time such as geometry). Please respond candidly. Your personal answers will be confidential-no single response will be attributed to you personally.*

1. When you compare integrated curriculum (more than one subject) to traditional curriculum (only one subject), the learning environment should be
less effective as effective more effective

2. When you compare the --- Greeting Card project to a regular geometry and/or art assignment, the learning environment should be
less effective as effective more effective

3. Compared to other high school projects, the content of the ---Greeting Card project should be
less relevant as relevant more relevant

4. Compared to other high school courses, the gaining of knowledge and skills through the --- Greeting Card project should require
less time as much time more time

5. Compared to other high school assignments, the --- Greeting Card project should be
less practical as practical more practical

6. Compared to the time and effort outside of class required in other high school courses, the --- Greeting Card project should require
less time same time more time

7. Compared to the study load required in other high school courses, the ---Greeting Card project should require
lighter load same load heavier load

8. Compared to the attitude toward learning created in other high school courses, the --- Greeting Card project should cause
poorer attitude same attitude better attitude

9. Compared to other high school courses, having more than one teacher available to you should be
less helpful as helpful more helpful

10. In the future, do you think you will be inclined to enroll in courses that use an integrated curriculum approach?
no not sure yes

11. Compared to other high school courses, your personal motivation while involved in the --- Greeting Card project should be
lower the same higher

12. Compared to other high school courses, with regard to preparing individuals for the real world of employment, integrated curriculum projects such as the --- Greeting Card project should be
less effective as effective more effective

Appendix B
TALK BACK FORM

Now that you have finished the project we would appreciate feedback on your experience. Time has gone by very quickly since our opening discussion concerning this "project" in pop-up/slide greeting card design. We will say more about our perceptions of the project later. We do not want to influence your responses to this exercise. We are always trying to improve our teaching so any feedback concerning this project is very important to us. Any and all comments are welcome. Please respond honestly and thoroughly to the following questions. Your personal answers will be confidential-no single response will be attributed to you personally.

1. How did you feel about the project when you first read what was involved?

2. Now that you have completed the project what are your feeling about it?

3. What did you learn from the project?

4. Tell me about any problems, ideas, solutions, you may have had with the incorporation of a tessellation design with a paper engineering (pop-up/slide) design

5. Tell me about any other problems or frustrations you may have had with the project.

6. Describe how rewards and incentives such as, field trips, good grades, or prizes, motivate you.

7. What recommendations do you have for improving this project?

8. What could we have done to make this a better learning experience for you?

9. Tell me what you did not like about the project.

10. Tell me what you liked best about the project.

Appendix C
Release Form

To: Parents of Students of Art/Geometry
Re: The ---Greeting Card Company Project
From: Susan Schramm
Date: February 14, 1996

Dear Parents,

In conjunction with the ---Greeting Card Company, I have selected several students to participate in a survey and an informal interview to determine their "feelings" about integrated curriculum (lessons that involve more than one subject at a time like geometry and art). Throughout his/her school career, your child has encountered a variety of teaching strategies and his/her comparisons between the traditional curriculum (lessons that involve only one subject at a time such as geometry) and integrated curriculum is valued.

Please be assured that all answers and opinions will remain confidential and no single response will be attributed to any individual student. Each interview will be conducted individually and the student is free to conclude the interview at any time without repercussions. Moreover, all interviews will be conducted after school at ---High School in the art room before the end of third quarter. The length of each interview will range from 45 minutes to one hour.

Please sign and return the bottom portion of this letter by February 20, 1996. Also, please feel free to contact me at any time should you wish to review the interview questions and responses.

****

_____has my permission to be surveyed and interviewed by Ms. Schramm regarding his/her feelings about integrated curricular projects and particularly the ---Greeting Card Project.

Parent/Guardian_____ Date_____

Appendix D
Interview Questions

•Tell me what kind of job you feel that ---High School has done preparing you for college or the workplace.

•Tell me about the time period (sequence of events) in which you started and finished the --Greeting Card project?

•Tell me how you felt when you finished the portfolio, and greeting card design.

•Now that you have completed the --Greeting Card project, what you see as the biggest difference between doing things the traditional curriculum way and doing things the integrated curriculum way?

•What do you think it would be like if the entire school was set up in an integrated curriculum format?

•Let's say art and math are not the best subjects to combine in an integrated project, what subjects do you think would be better?

•If you were a teacher and set out to create the perfect integrated project with your students what would you do?

•If you were a teacher studying integrated curriculum, what is interesting question about integrated curriculum you would ask your students?

•Describe to me the steps you typically follow when you have a problem you need to solve or project to complete in any of your other classes.

•Tell me about how you feel when you first learn you will be doing a big project.

•Tell me about how you felt when you first learned we would be doing the ---Greeting Card Project with Mrs. --- and her geometry students.

•Do you see any connection between projects that involve more than one subject relating to what you will someday be asked to do by a college professor?

•What is the biggest difference you see between doing things the traditional curriculum way and doing things the integrated curriculum way?

•Is there anything you don't like about integrated curriculum?

•Are there any questions I should have asked you about the project that I didn't?